NTRK1 gene

neurotrophic receptor tyrosine kinase 1

Normal Function

The *NTRK1* gene provides instructions for making a protein that is essential for the development and survival of nerve cells (neurons), especially those that transmit information about sensations such as pain, temperature, and touch (sensory neurons). The NTRK1 protein is found on the surface of cells, particularly sensory neurons. It acts as a kinase, which is an enzyme that changes the activity of other proteins by adding a cluster of oxygen and phosphorus atoms (a phosphate group) at specific positions. This process is called phosphorylation. The NTRK1 protein is turned on (activated) when another protein called nerve growth factor beta (NGFβ) attaches (binds) to it and signals the NTRK1 protein to phosphorylate itself (autophosphorylation). Then, the activated NTRK1 protein phosphorylates other proteins; this process is needed to transmit signals for cell growth and survival.

Health Conditions Related to Genetic Changes

congenital insensitivity to pain with anhidrosis

Mutations in the *NTRK1* gene cause congenital insensitivity to pain with anhidrosis (CIPA), a condition characterized by the inability to feel pain and decreased or absent sweating (anhidrosis). Many mutations in the *NTRK1* gene are known to cause the condition. Many of the *NTRK1* gene mutations lead to a protein that cannot be activated by phosphorylation, which means the mutated NTRK1 protein cannot transmit cell growth and survival signals to neurons. Without the proper signaling, neurons die by a process of self-destruction called apoptosis. Loss of sensory neurons leads to the inability to feel pain in people with CIPA. In addition, people with CIPA lose the nerves leading to their sweat glands, which causes the anhidrosis seen in affected individuals.

cancers

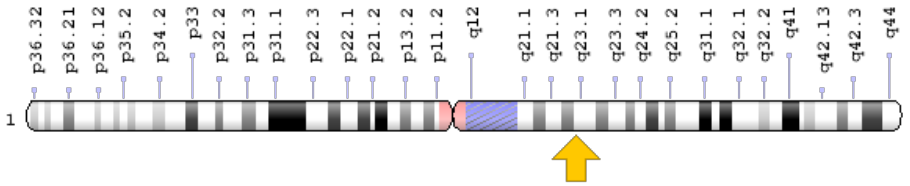
Mutations in the *NTRK1* gene are frequently found in people with a common type of thyroid cancer called papillary thyroid carcinoma. These mutations are acquired during a person's lifetime and are present only in certain cells. Such mutations are called somatic mutations. The mutations involved in papillary thyroid carcinoma occur when rearrangements of genetic material combine part of the *NTRK1* gene with another gene. At least three other genes are known to be involved in these rearrangements: the *TPM3* gene, the *TPR* gene, and the *TFG* gene. All of these

genetic rearrangements create mutated proteins called TRK oncoproteins. Unlike normal NTRK1 protein, TRK oncoproteins do not have to be activated by binding to the NGFβ protein; they are always turned on. Constant activation of the protein signals for the cells to grow and divide continuously, which can lead to papillary thyroid carcinoma.

Chromosomal Location

Cytogenetic Location: 1q23.1, which is the long (q) arm of chromosome 1 at position 23.1

Molecular Location: base pairs 156,815,750 to 156,881,850 on chromosome 1 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- high affinity nerve growth factor receptor
- MTC
- neurotrophic tyrosine kinase, receptor, type 1
- NTRK1_HUMAN
- p140-TrkA
- TRK
- Trk-A
- TRK1
- TRK1-transforming tyrosine kinase protein
- TRKA
- tyrosine kinase receptor A

Additional Information & Resources

Educational Resources

- Molecular Cell Biology (Fourth Edition, 2000): Neurotrophins Promote Survival of Neurons
  https://www.ncbi.nlm.nih.gov/books/NBK21716/#A6893

GeneReviews

- Congenital Insensitivity to Pain with Anhidrosis
  https://www.ncbi.nlm.nih.gov/books/NBK1769

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28NTRK1%5BTIAB%5D%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+1800+days%22%5Bdp%5D

OMIM

- NEUROTROPHIC TYROSINE KINASE, RECEPTOR, TYPE 1
  http://omim.org/entry/191315
- THYROID CANCER, NONMEDULLARY, 1
  http://omim.org/entry/188550
- TRK-FUSED GENE
  http://omim.org/entry/602498

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
  http://atlasgeneticsoncology.org/Genes/GC_NTRK1.html
- ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=NTRK1%5Bgene%5D
- HGNC Gene Family: Immunoglobulin like domain containing
  http://www.genenames.org/cgi-bin/genefamilies/set/594
- HGNC Gene Family: Receptor Tyrosine Kinases
  http://www.genenames.org/cgi-bin/genefamilies/set/321
- HGNC Gene Symbol Report
  http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=8031

- NCBI Gene
  https://www.ncbi.nlm.nih.gov/gene/4914
- UniProt
  http://www.uniprot.org/uniprot/P04629

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